

Review Committee questions

1. Please characterize the assumed labor contingency percentage with respect to the budgeted hours (for the costed labor resources and uncostered labor resources separately, if possible).
2. Provide a profile of the uncostered labor for the on-project scope, by Level 2 subsystem.
3. What is the potential savings for moving production items for the EM calorimeter towers and the inner HCal from BNL to universities?
4. Construct a list of large procurements and items of high risk for the calorimeter.
5. Provide a WBS tree at Level 4, which includes the potential universities assignments.
6. Provide a list of items that are on project scope but not included in the cost estimates.
7. For off-project scope – what are the likely sources of support, your certainty for receiving this support, and the total cost for this off-project scope.
8. What fraction of the cost of a silicon strip detector would be covered by Japan?
9. Please tell us about scope contingency for the project.
10. Is the nominal 2021 running start consistent with the likely RHIC running schedule? What has been assumed here?
11. Provide downselect dates for major systems.

1. Please characterize the assumed labor contingency percentage with respect to the budgeted hours (for the costed labor resources and uncosted labor resources separately, if possible).

Costed Labor

Uncosted Labor is 8 FTEs/year for 5 years of scientist effort and 8 FTE's/year for 5 years of student effort. This is not a unreasonable number of scientist and students for a collaboration to provide for an experiment under construction. During a RHIC run, for instance, non-BNL PHENIX collaborators provides 40 FTEs of scientists and students to operate the experiment.

Sum of FTE (1760)		Column Labels						
Row Labels	WBS Description	FY 16	FY 17	FY 18	FY 19	FY 20	FY 21	Grand Total
1.1	Project Management	2.9	5.7	5.7	5.7	5.7	2.7	28.3
	Administrative	0.3	0.6	0.6	0.6	0.6	0.3	3.0
	Engineering	1.4	2.8	2.8	2.8	2.8	1.3	14.0
	Proj Mgt Sci	1.2	2.3	2.3	2.3	2.3	1.2	11.4
1.2	Magnet	4.6	4.0	5.0	6.9	3.2	0.0	23.8
	Engineering	2.6	2.3	2.7	3.3	1.8	0.0	12.7
	Purchased Services			0.3	0.6	0.2		1.1
	Technical	2.0	1.6	2.0	3.1	1.2	0.0	10.0
1.4	EMCaL	1.5	4.2	4.7	13.2	12.5	0.1	36.3
	Engineering	0.9	1.8	1.0	0.4	0.8	0.1	5.0
	Technical	0.6	2.4	3.7	12.8	11.7		31.3
1.5	HCAI	4.6	6.2	4.8	8.7	10.3		34.7
	Engineering	1.9	2.0	1.4	1.2	1.8		8.3
	Purchased Services		0.0	0.0	1.7	0.1		1.9
	Technical	2.7	4.2	3.3	5.9	8.4		24.5
1.6	Cal Elec	1.4	2.5	1.6	2.9	0.2		8.7
	Engineering	1.1	1.9	1.3	1.8	0.2		6.3
	Technical	0.3	0.6	0.3	1.1	0.1		2.4
1.7	DAQ & Trigger	0.6	1.0	1.2	2.1	0.2		5.1
	Engineering	0.4	0.7	0.8	1.1	0.1		3.1
	Purchased Services				0.0			0.0
	Technical	0.3	0.3	0.3	1.0	0.1		2.0
1.8	Infrastructure	2.5	3.4	1.2	4.2	0.4		11.6
	Engineering	1.3	2.0	1.1	3.3	0.4		8.1
	Purchased Services			0.0	0.0			0.0
	Technical	1.1	1.3	0.1	0.9			3.4
1.9	Installation	0.7	0.6	1.5	2.5	3.6	2.9	11.9
	Engineering	0.4	0.6	0.8	0.8	0.7	0.4	3.7
	Purchased Services			0.2	1.0	0.9	0.2	2.3
	Technical	0.3		0.6	0.7	1.9	2.4	5.9
Grand Total		18.9	27.6	25.7	46.2	36.3	5.8	160.4

2) Provide a profile of the uncosted labor for the on-project scope, by Level 2 subsystem.

Sum of FTE (2059)			Column Labels ▾							
Row Labels	WBS Description	Group	FY 16	FY 17	FY 18	FY 19	FY 20	FY 21	Grand Total	
1.4	EMCaL	Student	0.00	0.05	0.42	8.07	13.31	0.00	21.86	
1.5	HCAL	Student	0.00	0.00	0.27	4.16	6.92	0.00	11.35	
1.6	Cal Elec	Student	0.00	0.00	0.00	2.22	0.38	0.00	2.60	
1.7	DAQ & Trigger	Student	0.13	0.28	0.51	1.88	0.42	0.00	3.22	
1.9	Installation	Student	0.00	0.00	0.00	0.00	0.00	2.49	2.49	
Grand Total			0.13	0.33	1.19	16.34	21.03	2.49	41.51	

Sum of FTE (1760)			Column Labels ▾							
Row Labels	WBS Description		FY 16	FY 17	FY 18	FY 19	FY 20	FY 21	Grand Total	
1.2	Magnet		0.7	0.6	0.6	0.6	0.5	0.1	3.1	
	Scientific		0.7	0.6	0.6	0.6	0.5	0.1	3.1	
1.4	EMCaL		2.3	2.6	1.5	2.3	3.7	0.1	12.4	
	Scientific		2.3	2.6	1.5	2.3	3.7	0.1	12.4	
1.5	HCAL		2.2	3.1	2.5	2.2	2.6		12.5	
	Scientific		2.2	3.1	2.5	2.2	2.6		12.5	
1.6	Cal Elec		0.3	0.5	0.3	0.1			1.2	
	Scientific		0.3	0.5	0.3	0.1			1.2	
1.7	DAQ & Trigger		0.9	1.6	1.7	2.4	0.4		6.9	
	Scientific		0.9	1.6	1.7	2.4	0.4		6.9	
1.8	Infrastructure		0.1	0.2	0.1	0.2	0.1		0.7	
	Scientific		0.1	0.2	0.1	0.2	0.1		0.7	
1.9	Installation		0.1	0.2	0.2	0.2	0.3	1.4	2.5	
	Scientific		0.1	0.2	0.2	0.2	0.3	1.4	2.5	
Grand Total			6.6	8.8	6.9	8.0	7.6	1.5	39.3	

3) What is the potential savings for moving production items for the EM calorimeter towers and the inner HCal from BNL to universities?

- We don't have enough information to answer that yet.

4) Construct a list of large procurements and items of high risk for the calorimeter

- EMCal Tower fabrication
- EMCal support mechanics
- Outer HCal steel
- Inner HCal Stainless steel
- Scintillating tiles for HCal

5) Provide a WBS tree at Level 4, which includes the potential universities assignments.

WBS	Name	Institution
1.1	Project Management	BNL
1.2	Magnet	BNL
1.2.1	Magnet Management and Technical Oversight	BNL
1.2.2	Magnet Systems Engineering & Design	BNL
1.2.2.1	Magnet Mechanical Coil/Core Modifications Engineering and Design	BNL
1.2.2.2	Cryogenics System Engineering & Design	BNL
1.2.2.3	Magnet Power Supply and Quench Protection Engineering and Design	BNL
1.2.2.4	Magnet Field Measurements Engineering & Design, Field Studies & Stress Analysis	BNL
1.2.3	Magnet Systems Fabrication	BNL
1.2.3.1	Magnet Mechanical Coil/Core Modifications Fabrication	BNL
1.2.3.2	Cryogenics System Fabrication	BNL
1.2.3.3	Magnet Power Supply and Quench Protection Fabrication	BNL
1.2.3.4	Magnet Field Measurements Equipment Purchase and Fabrication	BNL
1.2.3.5	Complete Magnet Parts/Component Fabrication	BNL
1.2.4	Magnet Systems Installation/Testing	BNL
1.2.4.1	Magnet Mechanical Coil/Core Modifications Installation and Testing	BNL
1.2.4.2	Cryogenics System Installation/Testing	BNL
1.2.4.3	Magnet Power Supply and Quench Protection Installation and Testing	BNL
1.2.4.4	Magnet Field Measurements Installation and Test	BNL
1.2.4.5	Complete Magnet Installation and Testing	BNL
1.3	Tracker	
1.3.1	Tracker Management	SBU, RIKEN
1.3.2	Pixel Detector	University? or LANL
1.3.2.1	Pixel Design	University? or LANL
1.3.2.2	Pixel Production	University? or LANL
1.3.3	Outer SiStrip Detector	RIKEN
1.3.3.1	Outer SiStrip Design (Mech and system)	BNL
1.3.3.2	SiStrip Prototyping	RIKEN
1.3.3.3	Outer SiStrip Production	RIKEN
1.3.3.4	SiStrip Electronics	LANL
1.3.4	Time Projection Chamber	
1.3.4.1	TPC Design	SBU
1.3.4.2	TPC Prototype	SBU, WIS
1.3.4.3	TPC Production	SBU
1.3.4.4	TPC Electronics	ORNL, BNL
1.3.5	Final Tracker Assembly/Testing Integration	BNL

5) Provide a WBS tree at Level 4, which includes the potential universities assignments.

37	1.3.4.4	TPC Electronics	ORNL,BNL
38	1.3.5	Final Tracker Assembly/Testing Integration	BNL
39	1.4	EMCal	
40	1.4.1	EMCal Management	BNL
41	1.4.2	EMCal Design	BNL
42	1.4.3	EMCal Prototype	UCLA, UIUC
43	1.4.3.1	EMCal Prototype v2	UCLA, UIUC
44	1.4.3.2	EMCal Preproduction Prototype	UCLA, UIUC
45	1.4.4	EMCal Production	UIUC
46	1.4.4.1	EMCal Tower/Module Production	UIUC
47	1.4.4.2	EMCal Module/Sector Assembly	UIUC
48	1.4.4.3	EMCal Module Testing/Calibration/Integration	UIUC
49	1.5	HCal	
50	1.5.1	HCal management	ISU
51	1.5.2	Inner HCal	WSU, ISU
52	1.5.2.1	Inner HCal design	BNL
53	1.5.2.2	Inner HCal prototype	WSU, ISU
54	1.5.2.3	Inner HCal production	WSU, ISU
55	1.5.3	Outer HCal	BNL
56	1.5.3.1	Outer HCal design	BNL
57	1.5.3.2	Outer HCal prototype	BNL+University
58	1.5.3.3	Outer HCal production	BNL+University
59	1.6	Calorimeter Electronics	BNL
60	1.6.1	CalElectronics Management	BNL
61	1.6.2	Calorimeter Optical sensors	BNL
62	1.6.2.1	EMCal Sensor Specification	BNL
63	1.6.2.2	EMCal Sensor Procurement	BNL
64	1.6.2.3	HCal Sensor Specification	BNL
65	1.6.2.4	HCal Sensor Procurement	BNL
66	1.6.3	Calorimeter on detector electronics	BNL
67	1.6.3.1	EMCal On detector electronics design	BNL
68	1.6.3.2	EMCal on detector electronics prototype	BNL
69	1.6.3.3	EMCal on detector electronics production	BNL
70	1.6.3.4	HCal on detector electronics design	BNL
71	1.6.3.5	HCal on detector electronics prototyping	BNL
72	1.6.3.6	HCal on detector electronics production	BNL
73	1.6.4	Calorimeter digitizer system	Columbia U
74	1.6.4.1	Calorimeter digitizer design	Columbia U
75	1.6.4.2	Calorimeter Digitizer prototype	Columbia U
76	1.6.4.3	Calorimeter digitizer production	Columbia U

5) Provide a WBS tree at Level 4, which includes the potential universities assignments.

77	1.7	DAQ&Trigger	Columbia U
78	1.7.1	Project oversight and Management	Columbia U
79	1.7.2	DAQ	BNL
80	1.7.2.1	DAQ Design	BNL or University
81	1.7.2.2	DAQ Prototype	BNL or University
82	1.7.2.3	DAQ Production	BNL or University
83	1.7.3	Trigger	University
84	1.7.3.1	Trigger LL1	University
85	1.7.3.2	Trigger: MB Detector	University
86	1.8	Infrastructure	BNL
87	1.08.01	Project Management and Oversight	BNL
88	1.08.02	Infrastructure Design	BNL
89	1.08.03	Infrastructure System Production	BNL
90	1.9	Install & Integration	BNL
91	1.09.01	Integration Supervision	BNL
92	1.09.02	Integration Management and Technical Coordination	BNL
93	1.09.03	Integration/Installation Tooling/Fixture/Procedures Design & Production	BNL
94	1.09.04	sPHENIX Installation	BNL
95	1.09.04.01	Infrastructure Installation	BNL
96	1.09.04.02	CP Carriage Assembly	BNL
97	1.09.04.03	sPHENIX SC Magnet Installation	BNL
98	1.09.04.04	Outer HCal Installation	BNL
99	1.09.04.05	Inner HCal Installation	BNL
100	1.09.04.06	EMCal Installation	BNL
101	1.09.04.07	Tracking Installation	BNL

6) Provide a list of items that are on project scope but not included in the cost estimates.

- Effort of BNL scientists other than management
- Space charges for assembly space

7) For off-project scope – what are the likely sources of support, your certainty for receiving this support, and the total cost for this off-project scope.

Outside funding possibilities:

- NSF MRI(\$4M) for EMCal electronics
- \$4.7M JSPS for SiTracker
- \$0.5M We would look for the MB Trigger device to be contributed from non-DOE sources.
- TPC proponents have expressed interest in also submitting NSF MRI (\$4M)
- In the past our international colleagues have contributed in kind labor. Potential for sPHENIX include Russia, Korea, Japan, Hungary, Israel. We haven't pursued this very actively yet.

7) For off-project scope – what are the likely sources of support, your certainty for receiving this support, and the total cost for this off-project scope.

		Date			Source
SC-Magnet low power cold test	Testing of the SC solenoid in 912 with <u>crvo</u> and 100A power	5/15	6 mo	C-AD, SMD, Phys <u>engs</u> and techs	BNL Program Development & RHIC Ops
Feasibility engineering study of an sPHENIX detector	Pre-conceptual engineering of the sPHENIX exp.	5/15	18 mo	C-AD, Phys eng and <u>sci</u>	Redirected RHIC Ops
Generic calorimeter R&D for a RHIC/EIC detector	Generic R&D for future calorimeters at RHIC/EIC	5/15	18 mo	Phys eng, <u>sci</u> , techs	Generic RHIC/EIC R&D
Generic Tracking R&D for a RHIC/EIC detector	Generic R&D for future Tracking at RHIC/EIC	5/15	18 mo	Phys eng, <u>sci</u> , techs	Generic RHIC/EIC R&D
Generic readout electronics R&D for a RHIC/EIC detector	Generic R&D for future readout electronics, DAQ/Trig at RHIC/EIC	5/15	18 mo	Phys eng, <u>sci</u> , techs	Generic RHIC/EIC R&D
Feasibility engineering study of sPHENIX calorimetry	Pre-conceptual engineering of calorimetry for sPHENIX	5/15	18 mo	Phys eng and <u>sci</u>	Redirected RHIC Ops
Feasibility engineering study of sPHENIX Tracking	Pre-conceptual engineering of Tracking for sPHENIX	5/15	18 mo	Phys eng and <u>sci</u>	Redirected RHIC Ops
Feasibility engineering study of sPHENIX readout/DAQ/Trigger	Pre-conceptual engineering of the readout/DAQ /Trigger for the sPHENIX exp.	5/15	18 mo	Phys eng and <u>sci</u>	Redirected RHIC Ops
SC-Magnet Full field test cold test	Testing of the SC solenoid in 912 with <u>crvo</u> , a temporary flux return and current ramped to full field	11/15	10 mo	C-AD, SMD, Phys <u>engs</u> and techs	BNL Program Development & RHIC Ops
Submit request for DOE permission to Decommission PHENIX	Paperwork submitted requesting permission to decommission PHENIX at the end of RHIC Run-16	1/16	1 mo	Physics scientists and engineers	

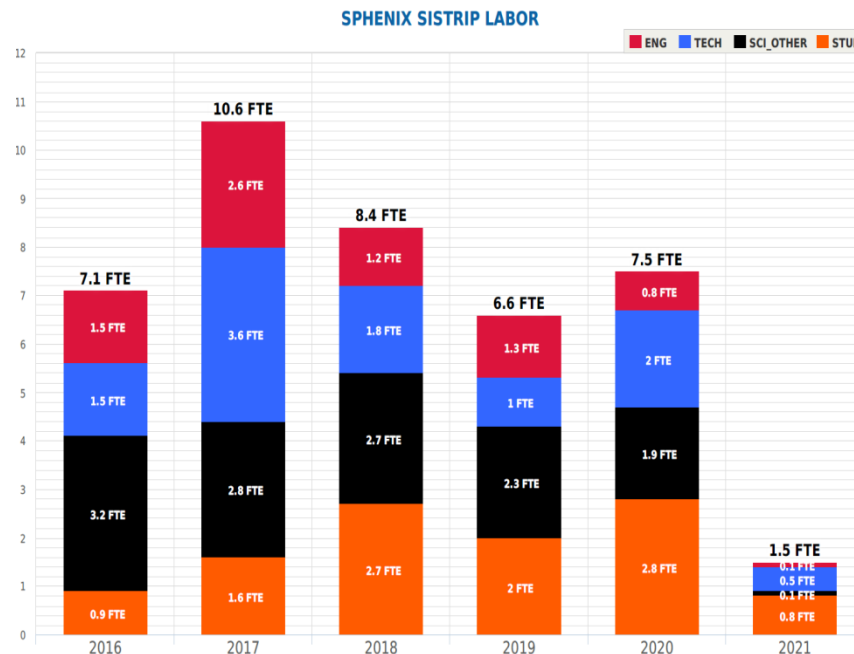
7) For off-project scope – what are the likely sources of support, your certainty for receiving this support, and the total cost for this off-project scope.

Decommissioning of PHENIX (Pending DOE approval)	Removal of PHENIX detector from 1008 and storage of some components for future use. Disposal and disposition of waste material.	7/16	18 mo	C-AD, Phys eng and techs	Redirected RHIC Ops
sPHENIX preliminary conceptual detector design	Preliminary conceptual design of sPHENIX in preparation for an OPA CD-1 review	10/16	8 mo	Phys and C-AD eng and scientists	CDR
Document preparation for a CD-1 review	Preparation of all documents required for a CD-1 review	10/16	8 mo	Phys and C-AD eng and scientists	CDR
sPHENIX calorimetry R&D	R&D on sPHENIX HCal and EMCal	10/16	12 mo	Phys eng, <u>sci</u> and techs	R&D
sPHENIX tracker R&D	R&D on sPHENIX Tracker	10/16	12 mo	Phys eng, <u>sci</u> and techs	R&D
sPHENIX readout electronics/DAQ/Trigger R&D	R&D on sPHENIX Readout electronics/DAQ/Trig	10/16	12 mo	Phys eng, <u>sci</u> and techs	R&D
sPHENIX final conceptual detector design and CD-1 doc revision	Final conceptual design of sPHENIX in preparation for ESAAB CD-1 approval	6/17	4 mo	Phys and C-AD eng and scientists	CDR
Clean up and generic preparation of the 1008 area for a future experiment	Clean up and prep of 1008 for a future experiment	1/18	6 mo	C-AD, Phys eng and techs	Redirected RHIC Ops

8) What fraction of the cost of a silicon strip detector would be covered by Japan?

- 100% of the material costs and ~50% of the labor. The engineering and techs working at BNL on the Si assembly would need to be covered from another source.

Summary of WBS 1.3 Tracker Fixed FY 16 k\$'s					
		k\$'s			
WBS	WBS Description	Labor	Material	Total	
Option 1 1.3	Tracker - Si	2926	4738	7664	



9) Please tell us about scope contingency for the project

- We've designed a bare-bones project with little obvious scope contingency. We would try to reduce costs by moving detector subsystem fab to universities and non-US institutions. This will be examined as the new collaboration forms.
- Future value engineering exercises will provide design, material and production options. There may ways to reduce the machining costs of the Inner and Outer HCal, the central pedestal, the pole tips, etc.

10) Is the nominal 2021 running start consistent with the likely RHIC running schedule? What has been assumed here?

Yes a RHIC run typically starts early in the year, January or February. Our goal in the standard project scenario is to be ready Jan 2021. The schedule scenario with the 1 year stretch has sPHENIX ready in Jan 2022.

11) Provide downselect dates for major systems.

- EMCal 1D vs 2D after v2 prototype complete May 2017. Though we may have sufficient information after the analysis of the Fall 2016 beam test
- Tracker Si vs TPC after v2 prototype mid-2017